

# WORK PLAN

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## **A Biogeographic Assessment off North/Central California, In Support of Revisions to Sanctuary Management Plans for NOAA's Office of National Marine Sanctuaries**

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*A Cooperative Investigation by the NOS' Biogeography Program,  
the Office of National Marine Sanctuaries, and the National Marine Fisheries Service*

### **GOAL**

NOAA's Biogeography Team will conduct a biogeographic assessment of the marine region off north/central California to identify important biological areas and time periods. This assessment is being conducted to support NOAA's Office of National Marine Sanctuaries (ONMS) in the revisions to management plans for the Monterey Bay, Gulf of the Farallones, and Cordell Bank National Marine Sanctuaries. Products from this assessment will include: 1) the development and biogeographic analysis of a marine geographic information system (GIS) for the area; 2) production of a report on the ecological components, links, and processes of the study area; and 3) support in the development of a GIS tool to support management in their analyses of biological resources.

### **OBJECTIVES**

1. Identify and collect relevant biological and physical data sets in the study area in order to conduct a biogeographic analyses. Organize the data sets into a Geographic Information System (GIS).
2. Conduct a marine biogeographic analysis of available data to identify important biological areas ("hot spots") and time periods, based on species distributions, abundance, habitats, and their ecological function. Produce a summary assessment report of the GIS analyses and results.
3. Produce a report on the ecological components, links, and processes of the estuarine and marine regions off north/central California.
4. Support development of a GIS capability/tool to assist sanctuary staff in developing and evaluating resource analysis scenarios.
5. Support ONMS staff in the integration of biogeographic assessment products into the revisions of the sanctuary management plans.

### **BACKGROUND**

NOAA's Office of National Marine Sanctuaries (ONMS) has begun the process to update sanctuary management plans for the three contiguous north/central California sanctuaries: Cordell Bank (CBNMS), Gulf of the Farallones (GFNMS), and Monterey Bay (MBNMS). The management plans for these sanctuaries have not been updated for over ten years and the status of the natural resources and their management issues in and around the sanctuaries may have changed. In addition, significant accomplishments in research and resource assessments have been made within and adjacent to the sanctuaries; it is important to incorporate this new and expanding knowledge base into the management plans.

As part of the joint management plan revisions, the ONMS would like to include a biogeographic analysis of the spatial and temporal distributions of marine resources off north/central California. The ONMS has requested the National Ocean Service's (NOS) Biogeography Program (BP) staff to join with ONMS headquarters and sanctuary field personnel to conduct these biogeographic assessments. This assessment includes the identification and characterization of important ecological areas and time periods off the north/central California coast, and also addresses existing and emerging issues concerning living marine resource management.

The purpose of this document is to present a work plan for the Biogeography Program (BP) to conduct the biogeographic assessment. This work plan is designed to be a “Living Document” and will be modified periodically as the project evolves.

This work will complement and build on a major effort conducted by NOS in the late 1980s that resulted in the “West Coast of North America, Coastal and Ocean Zones, Strategic Assessment: Data Atlas” (NOAA 1988-1990). This Atlas contains maps of key biological, physical, and economic characteristics of the marine environment of the West Coast. The Atlas complemented the Biogeography Program’s studies to define the biological and physical characteristics of adjacent estuarine systems, and included biogeographic analyses to define estuarine assemblages and inshore-offshore linkages between ecosystems (Pattillo et. al 1997, Emmett et al. 1991, Monaco et al. 1992).

Based on existing and available biogeographic information from NOS and other institutions, and discussions with ONMS staff on their management requirements, the BP staff plans to assemble and analyze biological data on the spatial and temporal distribution of important species and their habitats. The results of this work will be used to identify important ecological areas and time periods relevant to management issues across the three sanctuaries.

Questions to be addressed by this study include:

1. What and are the significant or key species and habitats in the study area relative to the area’s ecology and sanctuary management?
2. Where are these species and habitats located in space and time?
3. Which habitats and locations are “biological hotspots” (e.g. high diversity), and how are these areas utilized by living marine resources?
4. What and where are the important ecological linkages among species and habitats in this area?
5. What are the significant gaps in our knowledge and information on the biological and physical characteristics of the study area?

## **PROJECT TASKS**

Below are brief descriptions of the major tasks planned for the biogeographic assessment. Please see Figure 1 for a diagram of the proposed process and schedule for developing a biogeographic assessment of the three North/Central California Marine Sanctuaries.

### **Task 1. Project Planning and Implementation**

There will be several meetings with BP and ONMS staff in order to refine the objectives, tasks and products in the work plan. This work plan will describe the overall project and serve as a blueprint for implementation. Specific products are identified in the work plan; the final products will depend on the quality, quantity, and availability of data for analysis. Hence, close collaboration with ONMS staff will be required to ensure the Biogeography staff is well-informed on the resource management priorities for ONMS, and that the Biogeography staff has selected the most important species, habitat types, and data sets for analysis.

Once the preliminary objectives and products are defined and finalized, the data collection and biogeographic analyses (described below) will be structured to address the study questions.

#### **Task 1 Products:**

- A preliminary list of deliverables
- A preliminary list of important species, habitats and areas for consideration

### **Task 2. Initial Data Collection**

The primary path for identifying relevant data sets for biogeographic analysis will be through telephone surveys with sanctuary staff and other regional biological experts and also through the meetings described in Task 3. To a lesser extent, data will also be collected through searches of peer reviewed literature, over the Internet, and by review of unpublished data (e.g. gray literature). In addition, the Biogeography Team will assess the utility of NOS data holdings to determine which data sets are useful for this analysis. At a minimum, selected species and habitat

maps from the NOS West Coast Data Atlas will be digitized and incorporated into GIS format for use where comprehensive information is lacking.

#### Task 2 Products:

- List of contacts to meet with during September data reconnaissance trip (task 3)
- Preliminary table of available data sets

### **Task 3. Additional Data Collection**

There will be several small, informal meetings in September to meet with local experts in California to: 1) obtain key data sets and identify data gaps and other limitations to the analysis; 2) discuss overall project objectives and techniques; 3) further identify priority species, habitats, and data sets to be used for the biogeographic analysis; and 4) demonstrate some example biogeographic results. These meetings will aid in defining the scope, temporal, and spatial scales of biological and physical data needed to conduct the biogeographic analyses. The results of these meetings will aid in formulating data synthesis strategies and help determine the best approach to conduct the biogeographic analyses and meet the needs of the management plan revision process. ONMS staff will assist in planning and implementing these meetings.

#### Task 3 Tasks/Products:

- Conduct information gathering meetings in Sept. 2001 with ONMS staff and other local experts
- Summary report on meeting results
- A list of acquired and incoming data

### **Task 4. Preliminary Assessment, Data Formatting, and Selection of Analytical Techniques**

The BP staff will organize all data into a GIS to conduct the biogeographic analysis; this GIS will also be useful to other scientists and managers for their own analyses. Once data sets are obtained they will be formatted and organized into a preliminary DBMS and GIS to assess their quality and content. A major effort of this work will include the evaluation and selection of analytical techniques that are most appropriate to use for the data collected and the desired products.

Certain data sets may be synthesized in order to create complete data layers that span the study area. An effort must be undertaken to determine if and where independent biological and physical databases can be integrated or synthesized into new databases that support the biogeographic analyses. Figure 2 shows the general biogeographic process that will be implemented. The analyses may range from simple presence/absence of species in specific raster-based cells to complex statistical analyses, such as canonical correlation analysis to define spatial relationships between animal distributions and habitats. For example, using the species distribution data from the West Coast of North America Data Atlas, we may be able to define areas of high biological importance based on species richness within a cell, or linear combinations of biological and physical variables that provide significant correlation across study area cells (Figure 3). The variety and limitations of the various data sets are expected to have a major influence on the character of the biogeographic analyses. A preliminary approach to analysis will be presented to selected ONMS staff for comment and approval. Once the optimal approach to analysis and data manipulation has been identified, all data will be transformed into the appropriate DBMS and GIS format to conduct the biogeographic assessment.

#### Task 4 Products:

- A brief report and presentation describing the preliminary data collection and assessment.

### **Task 5. Data Analysis**

Data analysis will begin once the GIS data has been reformatted according to the selected analytical approach. The BP staff will conduct a set of biogeographic analyses to identify key biological areas and time periods based on: species distributions; species life history requirements and habitat affinities; the distribution of habitats; and measures of community structure (e.g., species diversity). A useful outcome of this data collection and analysis may also be the identification of data gaps in space, time, and function (e.g. ecological linkages). The complexity of these analyses will depend on the content and quality of the data sets collected described in task 4.

#### Task 5 Products:

- Quantitative and qualitative assessment results that define biogeographic patterns and relationships of single species, species assemblages, and measures of community structure within the study area defined by available data.

#### **Task 6. Developing GIS Products for Review**

Draft species, habitat, analysis maps (e.g. species richness, diversity), and statistical results will be made available to ONMS staff and other experts for review. In addition, a report will be developed that provides interpretation of the results of the biogeographic GIS analyses in non-scientific terms that can be easily integrated into the sanctuary management plans. A list of specific questions and comments will be provided to reviewers to obtain feedback on specific areas of the analysis.

#### Task 6 Products:

- Interim analytical results (maps, statistical results) from the biogeographic GIS
- A database on habitat affinities and utilization for selected species
- A list of comments and questions for reviewers
- A map and/or list of data gaps
- A brief report

#### **Task 7. Incorporate Review Comments and Present/Deliver Final Results**

Once products have been reviewed by selected ONMS staff and other experts, the BP staff will incorporate review comments and prepare final products in an appropriate format for inclusion into the sanctuary management plans.

#### Task 7 Products:

- A final summary report describing the analysis, results, and interpretation of the results
- A GIS on species, habitats, and important biological areas in the north/central CA study area
- A DBMS with data and information on species and habitats
- Results from GIS analyses, e.g., distributions and time periods of key species, habitats, and ecological areas

#### **Task 8. Produce a Report on the Ecological Linkages and Processes of the Central/Northern CA Estuarine and Marine Environment**

The objective of this task is to create a report that will complement the biogeographic GIS assessment. This report will be a synthesis of important ecological species, processes, and linkages in and around the central and northern California National Marine Sanctuaries. This report will provide a larger ecological context for the biogeographic assessment and will integrate information for many important species and processes for which sufficient data does not exist to be included in the GIS assessment. This report will address both estuarine and marine components of the ecosystem. The report will include a general description of ecosystems within the study region and a discussion of important biotic and abiotic habitats of the ecosystem. It will also include published biological and physical information on important biota including identification of key species, species life histories, connectivity of populations, dispersal, and the species' roles in the ecosystem (trophic interactions, competition, predation). The report will outline how the region is affected by large- and small-scale atmospheric/oceanographic phenomena (e.g., El Nino, upwelling). The report will also identify significant information gaps.

#### Task 8 Products:

- Develop a statement of work
- Principal investigators develop the preliminary ecological linkage report to be reviewed by NOAA staff
- Final ecological linkage report and presentations made to NOAA

#### **Task 9. Enhancing ONMS Analytical GIS Capabilities – Support in Developing a GIS Tool**

A GIS that displays the results of the biogeographic assessments and enables additional analyses based on a series of species and habitat management alternatives will be provided. This system would be similar to previous GIS projects that BP staff built in cooperation with ESRI (Gill et al., 2001), and will likely build on recent GIS tools (i.e.,

MaRIS) developed by CSC. At a minimum, this system will house the data used to conduct the biogeographic analysis and allow simple manipulation of those data layers. Development of a GIS tool is contingent on joint discussions between Coastal Services Center, ONMS, the BP staff, and possibly ESRI Inc. The BP can provide a suite of capabilities using ESRI's standard ArcView software, however, a more robust capability could be provided if ESRI is funded to work with CSC, ONMS, and BP staff to develop a GIS tool to conduct resource analyses and develop a variety of output scenarios.

#### Task 9 Preliminary Products:

- Draft concept and design of GIS tool
- Develop scope of work to modify existing tools developed by CSC

#### Task 10. A Web Site for the Biogeographic Assessment

This web site provides background information, updates, and interim products on the CA Biogeographic Assessment. It will also be used for analytical and product review. Visit the web site at:  
[http://biogeo.nos.noaa.gov/projects/assess/ca\\_nms/](http://biogeo.nos.noaa.gov/projects/assess/ca_nms/)

### **SCHEDULE**

See Figure 1 below for proposed project process and schedule.

### **RESOURCES**

#### **Biogeography Program Staff**

Dr. Mark Monaco – Marine Biologist and Biogeography Program Manager: Will serve as project co-coordinator and act as liaison between BP and ONMS staff and other parties as needed. Will ensure that project work plan is finalized and initiate implementation of activities. Supervise data synthesis strategies and biogeographic assessments.

Ms. Tracy Gill – Physical Scientist: Will serve as project co-coordinator and serve as liaison between BP and ONMS staff and other parties as needed. Responsible for the day-to-day management of the overall project. In addition, will be responsible for data evaluation and utilization of information and acquisition of bird and other data sets.

Mr. Ken Buja – Computer Specialist: Will serve as senior GIS manager and will be responsible for all aspects of data base management and integration into a GIS.

Mr. Chris Caldwell – Marine Biologist: Will serve as lead analyst for fisheries resources and support development of the ecological linkage report.

Mr. Matt Kendall – Marine Biologist: Will assist with project management, data analysis, and presentation.

Mr. Lawrence Claflin – Statistician: Will serve as lead statistician in the biogeographic analysis.

Ms. Wendy Morrison – Marine Biologist: Will conduct data collection, analysis, and GIS mapping for fisheries and other resources.

#### **Other Project Participants**

At a minimum, ONMS will provide staff support for project planning, meetings, data identification, collection, and synthesis. Collaboration with sanctuary research staff is essential; interim products will be offered for review at several points during the project in addition to those noted in this task list to ensure that deliverables will meet ONMS expectations. Staff from the National Marine Fisheries Service will participate in data collection and product review.

**Equipment**

Computer hardware and software including GIS software and a large format color map printer.

**Project Period**

The current project plan runs from March 2001 through August 2002

**SUMMARY OF POTENTIAL OUT-YEAR ACTIVITIES**

A great potential exists for many out-year activities as the proposed work is only a component of a greater NOS effort to develop a West Coast of North America Strategic Assessment capability to support coastal management issues. A primary issue of this work is to determine how best to design, define, locate, and manage an integrated suite of marine protected areas along the West Coast of North America. The proposed data synthesis, biogeographic GIS and analyses for the Central California sanctuaries project will provide a working prototype for a larger geographic investigation. A potential major out-year effort could be focused on a more complex and robust GIS project to support both the North/Central California work and the developing West Coast of North America program. It is anticipated that a partnership with ESRI, Inc. may be useful in developing such a GIS.

**CONTACTS**

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## REFERENCES

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## FIGURES

Figure 1. Proposed Process and Schedule for Conducting a Biogeographic Assessment off North/Central California

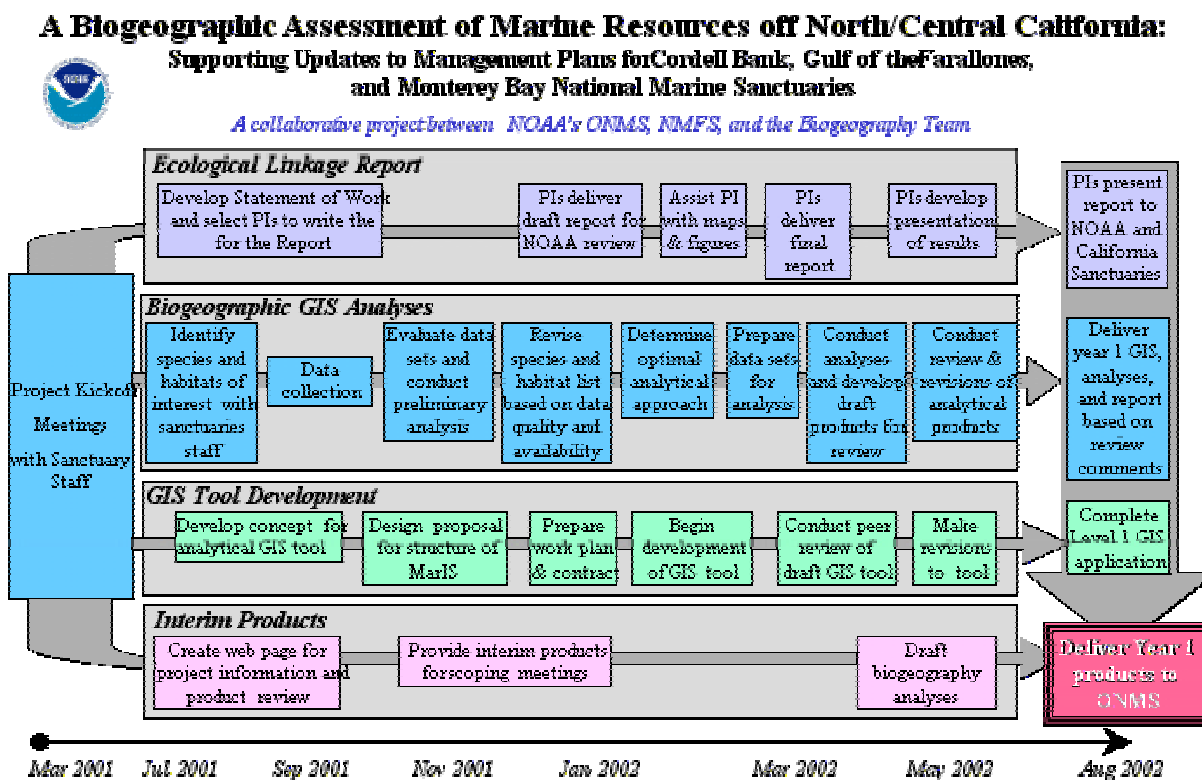


Figure 2. The General Approach to NOAA's Biogeographic Assessment and Modeling

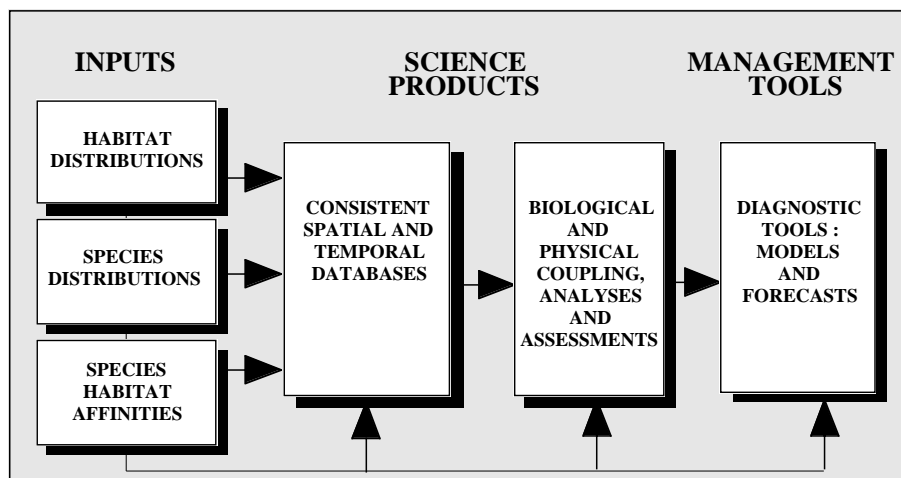


Figure 3. Forecasting important biological areas - example model input and output

